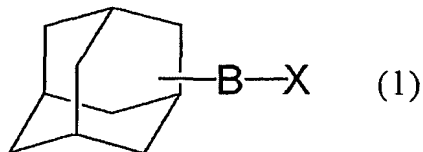
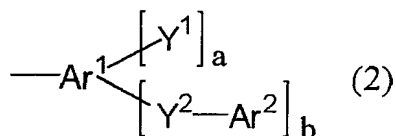


What is claimed is:

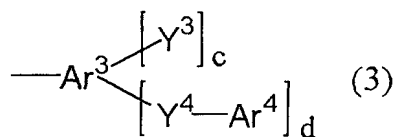
1. An adamantane compound represented by the formula (1).



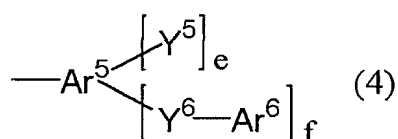
(wherein B represents a direct bond, an alkylene group having a carbon number of 1 to 6, an alkenylene group having a carbon number of 2 to 6, or an alkynylene group having a carbon number of 2 to 6, and X represents an organic group represented by the formula (2).



(wherein Ar¹ represents an optionally substituted three or more valent aromatic ring, Ar² represents an optionally substituted aryl group or an organic group represented by the formula (3), Y¹ represents an alkenyl group having a carbon number of 2 to 6 or an alkynyl group having a carbon number of 2 to 6, Y² represents an alkenylene group having a carbon number of 2 to 6 or an alkynylene group having a carbon number of 2 to 6, and a and b represent an integer of 0 to 5, respectively, a+b is from 2 to 5.)

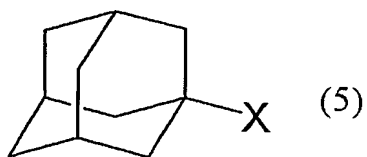


(wherein Ar³ represents an optionally substituted two or more valent aromatic ring, Ar⁴ represents an optionally substituted aryl group or an organic group represented by the formula (4), Y³ represents an alkenyl group having a carbon number of 2 to 6 or an alkynyl group having a carbon number of 2 to 6, Y⁴ represents an alkenylene group having a carbon number of 2 to 6 or an alkynylene group having a carbon number of 2 to 6, and c and d represent an integer of 0 to 5, respectively, c+d is from 1 to 5.)



(wherein Ar⁵ represents an optionally substituted two or more valent aromatic ring, Ar⁶ represents an optionally substituted aryl group, Y⁵ represents an alkenyl group having a carbon number of 2 to 6 or an alkynyl group having a carbon number of 2 to 6, Y⁶ represents an alkenylene group having a carbon number of 2 to 6 or an alkynylene group having a carbon number of 2 to 6, and e and f represent an integer of 0 to 5, respectively, e+f is from 1 to 5.)

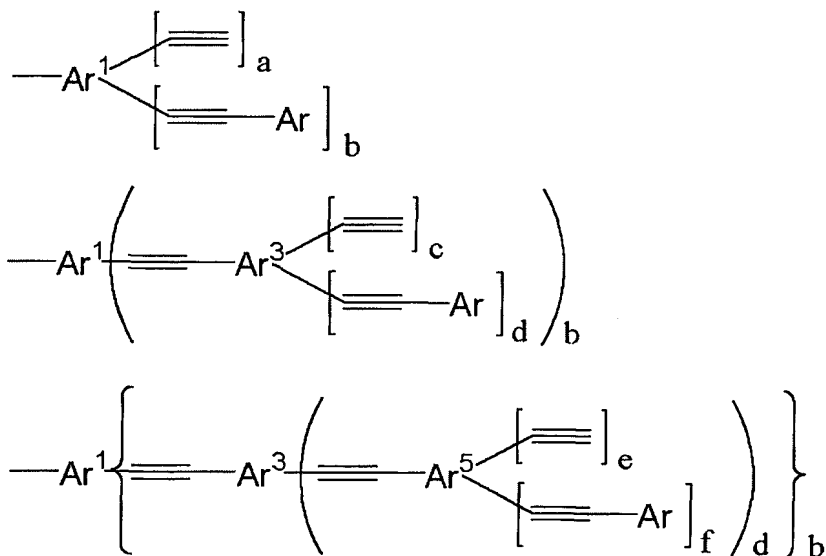
2. The adamantane compound according to claim 1, wherein the compound represented by the formula (1) is a compound represented by the formula (5).



(wherein X is as defined above).

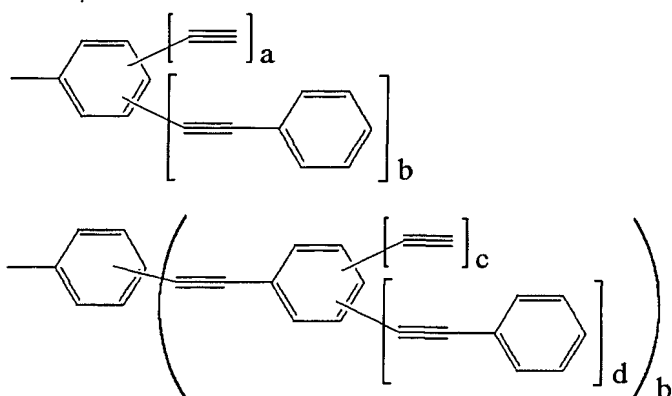
3. The adamantane compound according to claim 1, wherein Y^1 is an alkynyl group having a carbon number of 2 to 6, and Y^2 is an alkynylene group having a carbon number of 2 to 6.

4. The adamantane compound according to claim 1, wherein X is an organic group selected from the following group.



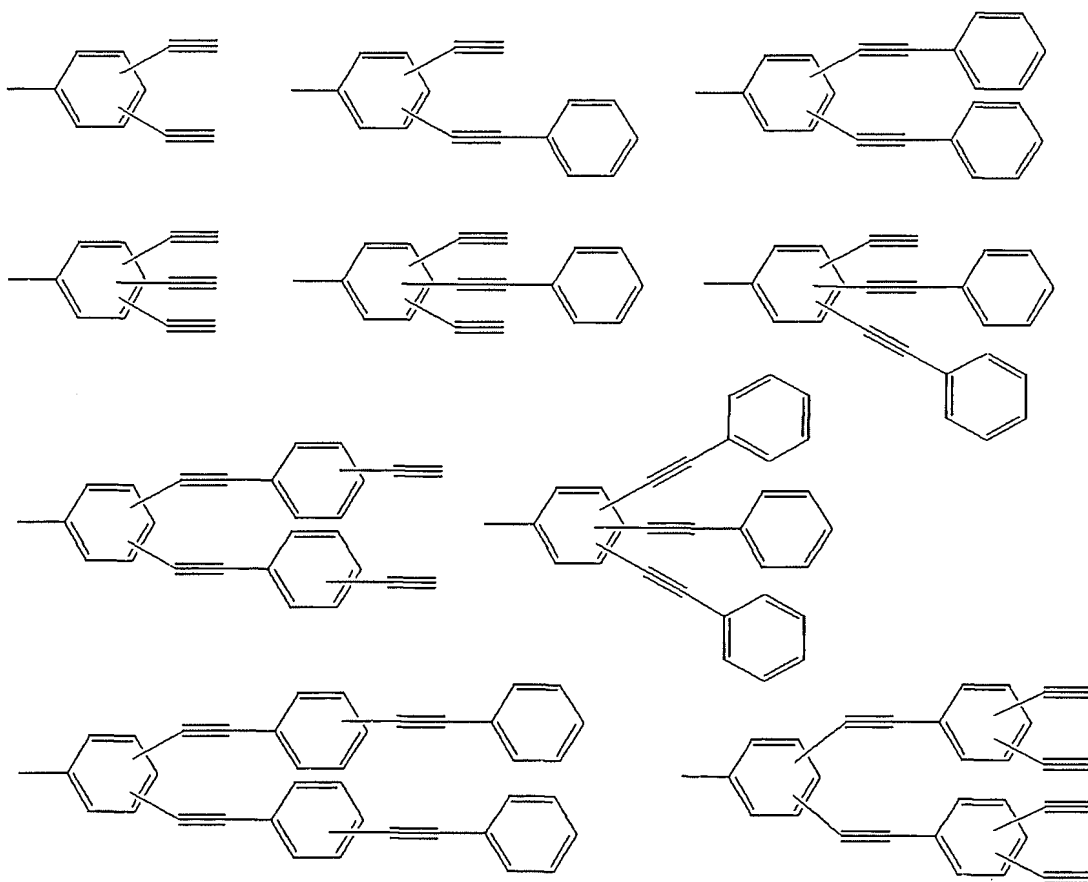
(wherein Ar^1 , Ar^3 , Ar^5 , a, b, c, d, e and f are as defined above, and Ar represents an optionally substituted aryl group.)

5. The adamantane compound according to claim 4, wherein X is an organic group selected from the following group.



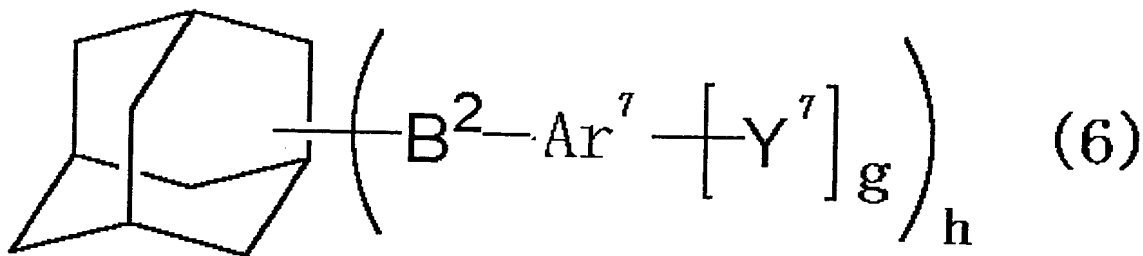
(wherein a, b, c and d are as defined above.)

6. The adamantane compound according to claim 1, wherein X is an organic group selected from the following groups.



7. A resin obtained by polymerizing the adamantane compound according to claim 1.

8. A coating solution comprising the resin according to claim 7 and at least one adamantane compound selected from the group consisting of the adamantane compound represented by the above formula (1) and at least one kind adamantane compound represented by the formula (6).



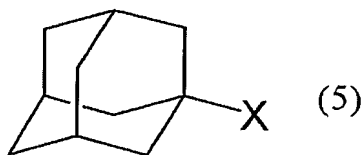
(wherein B^2 represent a direct bond, an alkylene group having a carbon number of 1 to 6, an alkenylene group having a carbon number of 2 to 6 or an alkynylene group having a carbon number of 2 to 6, Ar^7 represents an optionally substituted two or more valent aromatic ring, Y^7 represent an alkenyl group having a carbon number of 2 to 6 or an alkynyl group having a carbon number of 2 to 6, g represents an integer of 1 to 5, and h represents an integer of 2 to 4).

9. A method for forming an insulating film comprising coating

the coating solution according to claim 8 and heat treatment.

10. The method according to claim 9, wherein three-dimensional cross-linking is performed after heat treatment.

11. The coating solution according to claim 8, wherein the compound represented by the formula (1) is a compound represented by the formula (5).

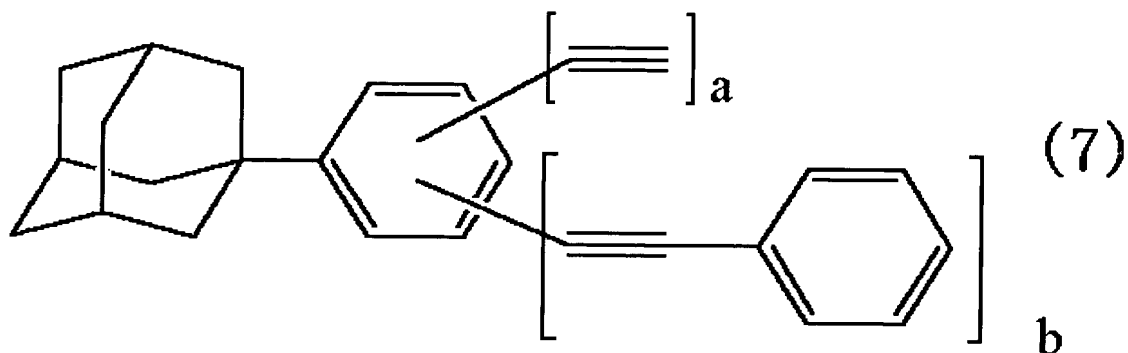


(wherein X is as defined above).

12. The coating solution according to claim 8, wherein Y^1 of the compound represented by the formula (1) is an alkynyl group having a carbon number of 2 to 6, and Y^2 of the compound represented by the formula (1) is an alkynylene group having a carbon number of 2 to 6.

13. The coating solution according to claim 12, wherein Y^1 is an ethynyl group, and Y^2 is an ethynylene group.

14. The coating solution according to claim 8, wherein the compound represented by the formula (1) is a compound represented by the formula (7).



(wherein a and b are as defined above)

15. The coating solution according to claim 8, wherein a+b of the above formula (1) is 2 or 3.

16. A coating solution comprising a resin obtained by polymerizing a mixture comprising at least one adamantane compound represented by the above formula (1), and at least one adamantane compound represented by the formula (6).

17. The coating solution according to claim 8 or 16, wherein B² is a direct bond.

18. The coating solution according to claim 16, wherein B is a direct bond.

19. The coating solution according to claim 16, wherein Y¹ of the compound represented by the formula (1) is an alkynyl group having a carbon number of 2 to 6, and Y² of the compound represented

by the formula (1) is an alkynylene group having a carbon number of 2 to 6.

20. The coating solution according to claim 16, wherein Y^1 is an ethynyl group, and Y^2 is an ethynylene group.

21. The coating solution according to claim 16, wherein the adamantane compound represented by the formula (1) is a compound represented by the formula (7), and the adamantane compound represented by the formula (6) is a compound represented by the formula (8).

(wherein a, b, c and d are as defined above.)

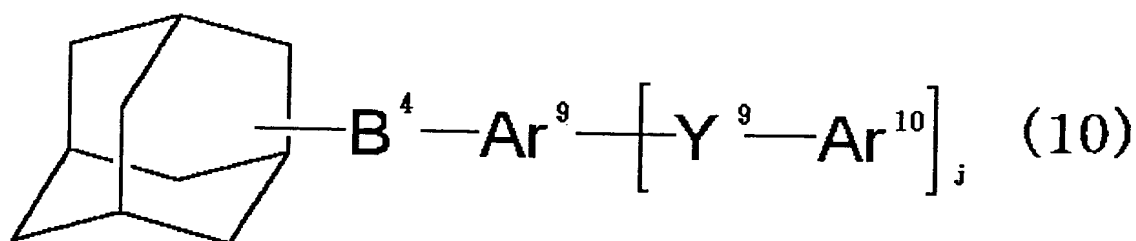
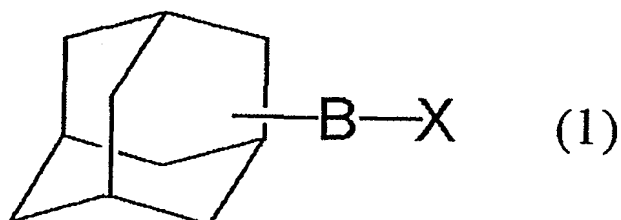
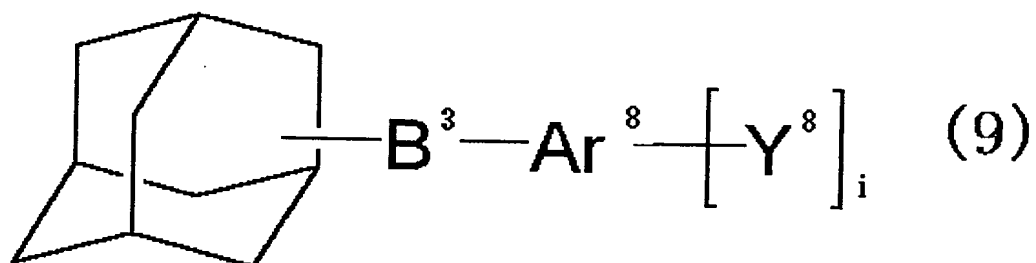
22. The coating solution according to claim 8 or 16, wherein $a+b$ is 2 or 3, c is an integer of 1 to 3, and d is 2 or 3.

23. A method for forming an insulating film comprising coating the coating solution according to claims 8 or 16 on a substrate, and heat treatment.

24. The method according to claim 23, wherein three-dimensional cross-linking is performed after heat treatment.

25. An adamantane resin, which is obtained by polymerizing a mixture comprising at least one adamantane compound represented by the formula (1), at least one adamantane compound represented

by the formula (9) and/or at least one adamantane compound represented by the formula (10).



(wherein B and X are as defined above, B³ and B⁴ represent independently a direct bond, an alkylene group having a carbon number of 1 to 6, an alkenylene group having a carbon number of 2 to 6 or an alkynylene group having a carbon number of 2 to 6, Ar⁸ and Ar⁹ represent independently an optionally substituted three or more valent aromatic ring, Ar¹⁰ represents an optionally substituted aryl group, Y⁸ represents an alkenyl group having a carbon atom of 2 to 6 or an alkynyl group having a carbon number of 2 to 6, Y⁹ represents an alkenylene

group having a carbon number of 2 to 6 or an alkynylene group having a carbon number of 2 to 6, and i and j represent an integer of 2 to 5.)

26. The adamantane resin according claim 25, wherein B, B³ and B⁴ are a direct bond.

27. The adamantane resin according to claim 25, wherein Y¹ and Y⁸ are an alkynyl group having a carbon number of 2 to 6, and Y² and Y⁹ are an alkynylene group having a carbon number of 2 to 6.

28. The adamantane resin according to claim 27, wherein Y¹ and Y⁸ are an ethynyl group, and Y³ and Y⁹ are an ethynylene group.

29. The atamantane resin according to claim 25, wherein the adamantane compound represented by the formula (a) is a compound represented by the formula (11), the adamantane compound represented by the formula (1) is a compound represented by the formula (7), and the adamantane compound represented by the formula (10) is a compound represented by the formula (12). (wherein a, b, i and j are as defined above.)

30. The adamantane resin according to claim 25, wherein i and j are 2 or 3, respectively, and a+b of the formula (1) is 2 or

3.

31. A coating solution comprising an adamantane resin according to claim 25.

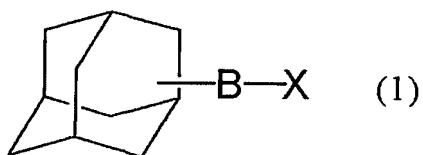
32. A method for forming an insulating film comprising coating the coating solution according to claim 31 and heat treatment.

33. The method according to claim 32, wherein three-dimensional cross-linking is performed after heat treatment.

Adamantane compound and insulating film forming coating solution

Abstract

The object of the present invention is to provide a novel compound which can prepare an insulating film having a low dielectric constant and excellent in the heat resistance. This object is achieved by an adamantane compound represented by the formula (1).



(wherein B represents a direct bond, an alkylene group having a carbon number of 1 to 6, an alkenylene group having a carbon number of 2 to 6, or an alkynylene group having a carbon number of 2 to 6, and X represents a monovalent organic group represented by the formula (2)).

